

Embodied creativity

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1 Questions of creativity

What does creativity produce? A concept is ‘a mental representation of a class of things’ Murphy (2002, p.5), and concepts are the primary output of a creative process. In other words, creativity is the process in which a creative agent recognises a new kind of thing, or modifies their understanding of a kind of thing, changing their view of the world in some valuable way. The visible output of a creative process may be a single thing, but it is the novelty and value of the concept behind the thing that shows creativity. The creative outcome is in the mind, not in a physical object.

Where are concepts represented? A conventional view is that conceptual representation, and indeed cognition in general is functionally separated from perception. Theories of embodied cognition however take the view that concepts are inherently perceptual; that concepts arise from recurrent states in sensory-motor systems, which in turn form the building blocks of higher level abstract thought. If we creatively generate new concepts, then we are literally altering our perception of the world and of ourselves.

How are concepts represented? How a concept is represented in human cognition is an open question, for example one view is that a concept is represented by a single best example or *prototype*, and another being that a concept is represented by a large number of memories, or *exemplars*. Theories of embodied cognition such as perceptual symbol systems proposed by Barsalou (2009) and conceptual spaces proposed by Gärdenfors (2000) take the prototype view. For example according to Barsalou (2009) concepts are based on incomplete, distorted and often vague summaries of prior perceptual states. Barsalou attributes the unpopularity of embodied cognition to the lack of understanding of this fragmentary and partly subconscious nature of perception. Gärdenfors (2000) also takes a prototype view, but in addition proposes that concepts are inherently *geometric*, where conceptual properties are convex regions within the quality dimensions of conceptual domains. He goes on to base a system of cognitive semantics on this geometric view, grounded in spatial metaphor as mappings between geometric domains.

What is creative search? Creativity is described by Boden (1990) and formalised by Wiggins (2006a,b) as a search in a space. Three sets of rules are employed in this search; rules defining *traversal* of the space, *evaluation* of the concepts found in the space, and *the space itself*. However, a creative search is more than a reactive process of traversal and evaluation. Creativity also requires introspection, self-modification and for boundaries to be broken. In other words, the rule sets described above need to be examined and challenged by the agent following them. In the terms of Gärdenfors (2000), the search space is a concept, and the search is for concept instances.¹

¹The terms used by Gärdenfors (2000) diverge from those used by Wiggins (2006a,b). Wiggins uses the term *conceptual space* in the place of Gärdenfors’ *concept*, and *concept* in the place of *concept instance*. The meaning is however the same, particularly when the recursive heirarchy of Wiggins’ theory is taken into account.

For example in a creative search for music within a genre, the genre would be the concept and a piece of music conforming to a genre would be a concept instance.

Artists often speak of self-imposed constraints as providing creatively fertile ground. In terms of a creative search such constraints form the *boundary* of a space. It is possible for a search to traverse beyond that boundary, thus finding *invalid* concepts. If invalid yet (according to evaluation rules) valued concepts are found, then the space should be enlarged to include the concept. An invalid concept which is not valued indicates that our traversal strategy is flawed and should be modified to avoid such concepts in the future. A single traversal operation may result in both valid and invalid concepts being found, indicating both the traversal rules and the definition of the space should be modified. Returning to our musical example, we can think of a creative piece of music that has altered the boundaries of a music genre, or defined a whole new genre. Indeed music which does not break boundaries to any degree could be considered uncreative.

It is important to recognise that changes in conceptual structures first happen in an individual, which in the case of music would be the composer or improviser. Another individual's conceptual structures may be modified to accord with a composer's new concept by listening to the new concept instance, although success is only likely if the individual already shares the music cultural norms of the composer.

2 Embodied creative search

Wiggins (2006a,b) formalises creative search in order to provide a comparative framework, and so is agnostic to views of representation. However by taking the view of embodied cognition summarised here, we may define *embodied creative search*, where sensory-motor faculties are used to navigate a geometric space, in direct metaphor to a search through a physical space. In this view, creative computation requires concepts to be represented in a manner at least sympathetic with the way humans perceive, act and introspect. More detail on this position in the context of musical creativity is given by Forth et al. (2008). Further, an approach to symbolic description of musical sounds informed by human perception termed *vocable synthesis* is provided by McLean and Wiggins (2009). Both papers are available for download on the Dagstuhl seminar website alongside this position statement.

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